Predicting Surface Erosion From Roads in Washington State

Authors
Kathy V. Dubé[1]
Walter F. Megahan
Marc McCalmon

Erosion from forest roads can be a large source of sediment in watersheds managed for timber production. Timberland owners and tribal, state, and federal resource managers cooperatively developed empirical methods to quantify road surface erosion as part of the Washington DNR's Watershed Analysis Methods in the 1990's. Since that time, these methods have been further refined and integrated into a GIS model (SEDMODL) developed by Boise Cascade and the National Council for Air and Stream Improvement. The DNR and the UPSAG working group of CMER have further adapted the road erosion calculations into an updated Washington Road Surface Erosion Model (WARSEM). The goals of the WARSEM project have been to provide users with a standardized, repeatable method to estimate road surface erosion and sediment delivery to channels that can be used for monitoring and assessing achievement of CMER performance targets.

The Washington Road Surface Erosion Model is a database tool that allows users to estimate average annual road surface erosion and sediment delivery to channels in a standardized manner using empirical relationships between road characteristics and sediment production. The model is intended for use on forest roads in Washington State, and can be applied on a variety of scales, ranging from a single road segment to all roads within a watershed. The model is designed to interface with a GIS system if such spatial data information are available. The analysis can be carried out at 4 different levels, depending upon the purpose of the analysis and the level of detail of data available for the roads:

> **Level 1 – Screening.** Assessment tool for determining relative sediment input using little site-specific information. Useful for screening road system to prioritize field work.
> **Level 2 – Planning-level Assessment.** Assessment of erosion and delivery appropriate for use during road maintenance planning or sediment budgeting using minimal site-specific information.
> **Level 3 – Detailed Assessment and Scenario Playing.** Detailed assessment of erosion/delivery using field-verified data on each road segment. Ability to determine reduction in sediment delivery resulting from potential road maintenance or Best Management Practices (scenario playing).
> **Level 4 – Site/Segment Level Monitoring.** Ability to track changes in road segment attributes and erosion/delivery resulting from road maintenance or BMPs through time.

The user has the ability to update and track road records as new information for the roads becomes available as a result of field inventories or improvements from maintenance or BMPs. Users can specify past, present, or future dates for calculation, allowing resource managers to estimate changes in road surface erosion through time in response to alternative road management activities.

The manual provided with the model provides standardized field protocols to help users collect data on roads in a consistent manner. Testing of the field protocols using un-trained observers suggested that training of field personnel is important if consistent, repeatable results are desired. Based on an analysis of sensitivity, the most care should be taken in determining road age, traffic use, surfacing, road width, and runoff/delivery characteristics.

[1] Watershed GeoDynamics, 14145 97th Avenue NE, Bothell WA 98011, PHONE 425-823-7918, EMAIL: kdube@watershednet.com